OPERATION & INSTALLATION

MANUAL

AIS RX CARBON
&
AIS RX CARBON +

TRUE HEADING

Version 1.1E

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1 REVISSION

Version	Date	Responsible	Approved	Changes
P1.0E	2010-05-31	Anders Bergström	Nils Willart	Preliminary version
1.0E	2010-06-02	Anders Bergström	Nils Willart	First release
1.1E	2010-06-09	Anders Bergström	Nils Willart	Error on power connector cable

2 INTRODUCTION

We like to thank you for choosing True Heading AB to deliver your AIS RX CARBON, AIS receiver. AIS RX CARBON is a high quality AIS receiver using VHF technology. AIS RX CARBON makes it possible to receive information from ships, buoys, lighthouses, SAR helicopters, Coastguard units, Pilot boats, Weather station etc. that are equipped with Automatic Identification System (AIS) transponders. It is today a requirement for all ships above 300 GT to carry AIS according to IMO, SOLAS regulation. This means that a large quantity of ships and other type of navigational hazards or information providers will be seen by your receiver and contribute to enhanced safety in your navigation.

Picture 1 Real traffic scenario between Sweden and Bornholm (Denmark)

It is of utmost importance that you read this manual before you start to install and use your AIS RX CARBON.

3 GLOSSARY

To make the reading of the manual easier we like to start up with introducing the used abbreviations and glossary:

AIS	Automatic Identification System
ATC	Air Traffic Control
DGPS	Differential Global Positioning System
ETA	Estimated Time of Arrival
GPS	Global Positioning System
GALILEO	European equivalent to GPS
GNSS	Global Navigation Satellite System
IMO	International Maritime Organization
NM	Nautical Mile = 1852 m
RX	Receive/Receiver
SMA	Swedish Maritime Administration
SOLAS	Safety Of Life At Sea
SOTDMA/STDMA	Self Organized Time Division Multiple Access.
VHF	Very High Frequency
VTS	Vessel Traffic Services (Like ATC but for ships)

4 CONDITIONS

Before you start using the AIS RX CARBON product from True Heading AB it is important that you read and fully understand the installation manual and its instructions. You should only proceed with the installation if you are confident that you will be able to do so.

True Heading AB cannot be held liable for any injury or damage caused by, during or because of the installation of AIS RX CARBON or SeaClear . The AIS RX CARBON is used at your own risk and it shall be remembered that AIS and GPS data depends on the full co-operation of other users and systems.

AIS RX CARBON is a navigation aid and works in co-operation with other similar systems like e.g. radar, optical lookout etc. The AIS RX CARBON installation should be inspected from time to time and checked on its operational quality frequently by the user. Remember that navigation and life at sea always requires proper seamanship and that the AIS RX CARBON is not a replacement for such qualities.

SeaClear is only a navigational aid. It collects, calculates and displays data for you, but there is no guarantee it is correct, there are many sources for errors. SeaClear is not a replacement for navigational knowledge, nor can it navigate by it self. Use it with care. Always have the original charts available when SeaClear is in use. True Heading does not take any responsibility for functionality of SeaClear, neither are we responsible for any charts used in conjunction with SeaClear.

NOT ALL VESSELS CARRY AIS. IT IS THEREFORE IMPORTANT TO KEEP PROPER LOOKOUT AT ALL TIMES AND TO USE ALL AVAILABLE MEANS TO AVOID COLLISIONS AND ACCIDENTS.

WARRANTY

5.1 General

AIS RX CARBON is developed and manufactured to meet high technical requirements and user demands. If installed correctly and with regular maintenance your AIS RX CARBON should provide you with several years of operation and a very useful product. For further information provided in the manual and in this information sheet please consult the place where you purchased the AIS RX CARBON or direct to our support.

5.2 Warranty conditions

- The warranty belongs to the person that purchased the product and cannot be handed over to a third party or person.
- The warranty is not valid if serial number is missing, seals broken or if the AIS RX CARBON has been incorrect installed. Neither is the warranty valid if instructions for connection have not been followed, faults caused by wrong usage, own made modifications or service made from none authorized service stations.
- True Heading AB acknowledges that AIS RX CARBON at delivery has been controlled and found operational.
- True Heading AB agrees to repair or replace any faulty unit without any cost according to the conditions set forth during a period of two (2) years from day of purchase.
- The warranty includes replacement or repair of faulty unit due to error in components or errors in relation to the production of the product.
- The warranty covers costs for spares, labor, and return shipment. It does not include shipment from to the repair facility.
- True Heading AB will never be liable under the warranty conditions for incorrect use, misuse, and incidental, indirect or consequential damages of the AIS RX CARBON.
- Proof of purchase is required for any warranty claim of the AIS RX CARBON.

5.3 Warranty procedures

True Heading AB repairs and replaces faulty parts or units. The customer is responsible for transport of the defect part or unit to True Heading or its retailer.
Warranty claims shall be made to the place where AIS RX CARBON was purchased or direct to True Heading AB through mail, fax or e-mail to our support department.

5.4 Other issues

Proper seamanship and common sense is applicable when using AIS RX CARBON and the products shall only be seen as a navaid. True Heading AB keeps the right to change the specification of the product without prior notice.

IF YOU ARE NOT ABLE TO ACCEPT THE TERMS ABOVE, PLEASE RETURN THE AIS RX CARBON TO YOUR RETAILER FOR FULL CREDIT BEFORE OPENED AND USED.

5 SUPPORT

If you need support, please contact the closest reseller or the location where you acquired the product.

The manufacturer can also give support direct:
Email: support@trueheading.se or Fax: +46 8 54593910.

Please register your purchase of AIS RX CARBON with True Heading AB by sending an e-mail to register@trueheading.se stating the serial number, date of purchase, your name, address and your dealer's name.

7 INFORMATION ABOUT AIS

7.1 General

AIS (Automatic Identification System) is the name of a system that makes it possible for ships to identify other ships and to monitor ship movements. The reason for implementing the AIS system is for the mariner to obtain more information about ships in the vicinity than what radar is able to provide. AIS gives e.g. information about a ships identity (name, call sign, IMO number and MMSI), size this even for ships behind Island or bends that radar cannot detect.

AIS is used to enhance safety for life at sea, improve safety and efficiency in navigation and protect the marine environment.

AIS-information transmitted from a ship contains of three (3) different main types:

- Static data that was programmed into the AIS equipment at installation and it only needs to be changed if the ship changes its name, flag or undergoes a major refit where size or ship type is changed;
- Dynamic data contains information that automatically is updated from ship sensors like the heading from the Gyro, Position and speed from GNSS equipment. Also navigational status belongs to the group of dynamic data but is updated manually by the crew; and
- Voyage related data that manually is updated by the crew along the voyage.

From the start AIS some times also was refereed to as UAIS or as the 4S transponder system that meant Ship to Ship and Ship to Shore.

IMO adopted 1998 a performance standard for AIS within the SOLAS requirement that described in general how AIS should work. Below follows a brief description of the main requirements for AIS from the performance standard:

- Automatically provide information to AIS land stations, other ships and airborne units e.g. SAR helicopters about the ships identity, Type of ship, Position, Course, Speed, Navigational status (e.g. under way using engine, at anchor) and other safety related information of importance.
- Be able to receive the same type of information from other ships.
- Be able to monitor and track other ships.
- Exchange information with land based AIS systems.

AIS is an automatic system that continuously and simultaneously transmits on two channels in the maritime VHF frequency band.

AIS can handle several reports in a rapid consecutive flow. To accomplish these AIS uses a technique called Self Organized Time Division Multiple Access (SOTDMA) that guarantees high transmission safety and operational robustness.

AIS also allows for other types of information from e.g. sensors like Gyro, GPS and echo sounders etc. to be transmitted automatically.

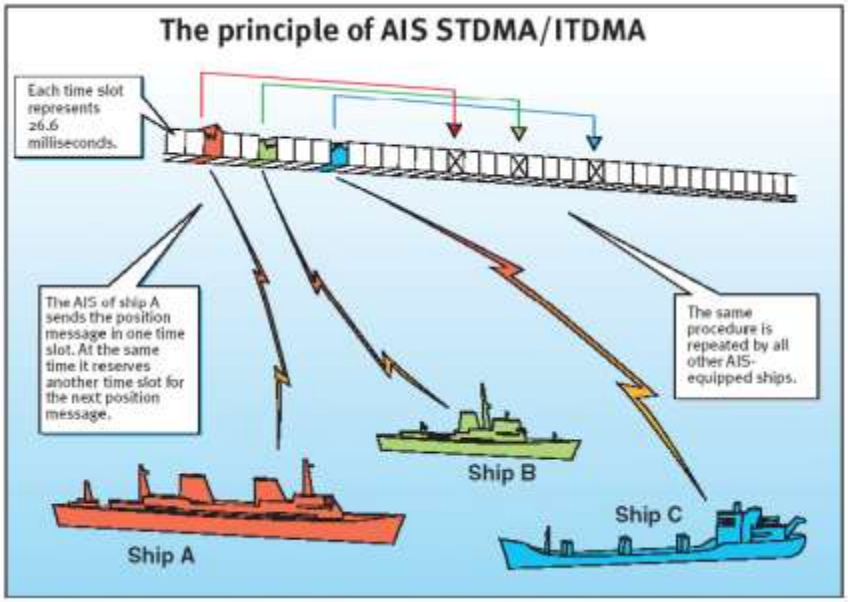
Important areas where AIS is used are:

- Information exchange between ships within VHF range (normally 20-30 NM) to enhance safety at sea and to improve situation awareness.
- Information exchange between ships and AIS land stations as e.g. a VTS that controls and monitors maritime traffic in an area.
- Automatic reporting in areas with mandatory reporting of different kinds.
- Exchange of safety related information between ships and between ships and land stations.
- Services like e.g. meteorological information in real-time from areas of importance, identity and position of floating and fixed aids to navigation to improve identification and navigation.

7.2 Short technical description of AIS

AIS operates primarily on two dedicated VHF-frequencies (AIS1 – 161,975 MHz and AIS2 – 162,025 MHz). In areas where these two channels are not available, AIS can automatically change to other alternatively available frequencies.

AIS uses two VHF radio channels, where the information is transmitted in short data packages or slots in predefined and synchronized time frames. The dynamic information (position, speed, heading etc) is transmitted in intervals from 2 s up to 10 s, depending on the speed and maneuvers of the transmitting ship were the AIS is mounted. Static and voyage related information (type of ship, size, cargo, destination etc.) is transmitted every sixth minute or upon request from other units. Position, course and speed normally are collected from the same sensor systems that provides the same information used in the navigation e.g. in radars or ECDIS and this is normally based on GPS or DGPS. All ships within VHF coverage will be able to receive AIS data and competent authorities that have installed networks with coastal AIS coverage can receive the information. The capacity for the ships to report is defined by the IMO performance standard to a minimum of 2000 data packages or slots per minute (see picture 2). ITU *(Technical Standard for the Universal AIS*) has been kind to double this and has provided AIS with 4500 data packages or slots per minute. The transmission is based on the (SO)TDMA (*Self-organized Time Division Multiple Access)* technique, that allows the system to overload with 400 till 500 % and still give almost a 100 % message throughput between ships that are closer to each other than 8 to 20 nautical miles. In such case the system overloads targets far away will be discriminated in favor of targets close to your own ship. In reality, the system capacity is unlimited and allows for a large number of ships to communicate simultaneously.


The principle of AIS STDMA/ITDMA
Each time slot represents 26.6 milliseconds.
The AIS of ship A sends the position message in one time slot. At the same time it reserves another time slot for the next position message.
The same procedure is repeated by all other AIS-equipped ships.
Ship A
Ship B
Ship C

Picture 2 The principle of AIS technology on the two radio channels.

7.3 Limitations with AIS

You should always be aware that all ship others ships and in particular pleasurecrafts, fishing boats, warships and some coastal stations and VTS centers not will be equipped with AIS. Ships that have been mandated to carry AIS can also under certain conditions turn of there AIS equipment at the master's disgrace. Therefore it is important to be aware that the information that AIS provides might not be the full and complete picture of the situation around your ship.

Users of AIS must also be aware that transmission of false data can occur and that this will be hazardous not only to your own ship but to other as well. The user is responsible for all data that is entered into the system and for information provided by external sensors. The accuracy of received AIS data is only as good as the information transmitted from the source of information.

You should always be aware that wrong configured or calibrated ship sensors (positions-, speed- or heading sensors) could lead to that wrong information will be transmitted. Dangerous situations can occur if fauly information is shown on another ship.

8 AIS RX CARBON

8.1 General description

With your AIS RX CARBON you will be able to ”see” other ships that has been equipped with AIS and comes within your VHF coverage area. Information transmitted is e.g. name on the ship, call sign, Heading, Speed, Course, Destination and Type of ship. AIS RX CARBON complies to the NMEA0183 and IEC 61162-1 standards and can be connected to all kind of ECS or radar system that supports these formats and has the capacity to display AIS targets and data. The installation is quick and easy since it only requires power connection, a VHF antenna and then a data cable to your display system and proper setup of the same. AIS RX CARBON is a very good complement to radar, since ships carrying AIS will be easy to identify on the radar screen.

8.2 Technical specification

AIS RX CARBON is a compact, two-channel receiver with a synthesized VHF receiver that operates in the maritime VHF frequency band. It has been designed to receive and decode transmissions from other AIS transceivers.

8.2.1 Electrical data

Power 1:	9 - 15 Volt DC
Power 2:	Power over USB (5V)
Powerconsumption:	< 1 W

8.2.2 Data output

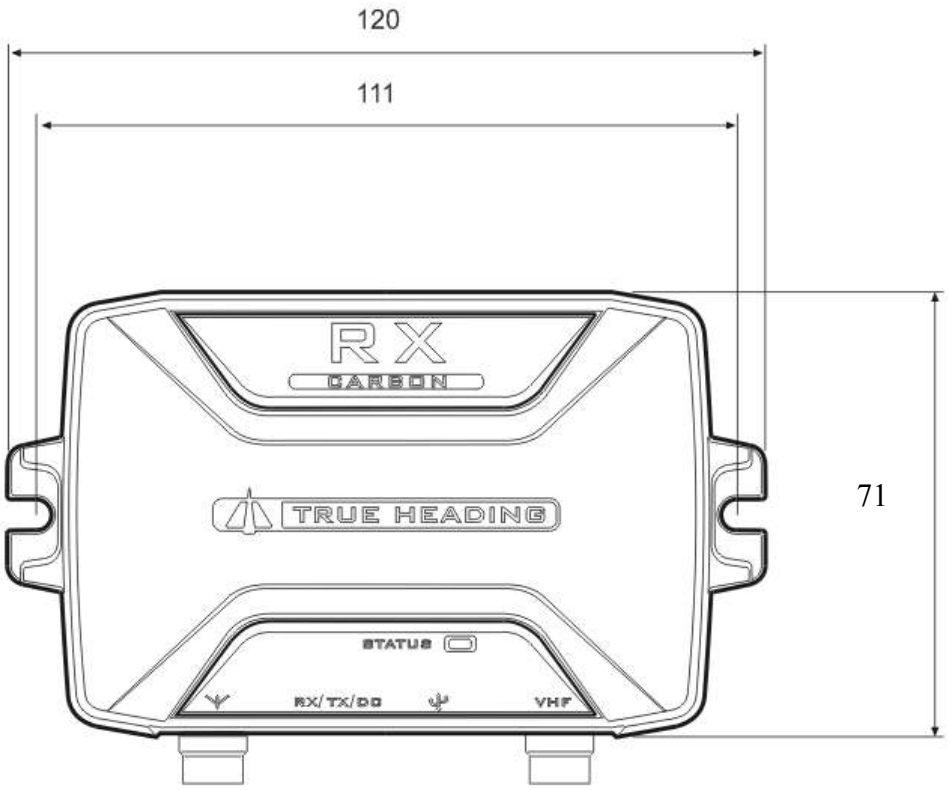
Data Speed:	38400 b/s (default)
Format :	NMEA 0183 ver. 3
Out data NMEA messages:	VDM, RMC

8.2.3 Receiver

Frequency:	AIS1 161.975 MHz
	AIS2 162.025 MHz
Sensitivity:	-112dBm
Antenna impedans:	50 ohm

8.2.4 Physical data

L x W x H:	120 x 80 x 29 (mm)
Weight:	138 g
Connectors:	VHF Antenna = FME
	VHF Radio = FME (Plus version only)
Data output port:	NMEA 183 (RS422) TX A and TX B
	USB Mini



Picture 3Size of the AIS RX CARBON

9 HOW TO INSTALL AIS RX CARBON

9.1 Introduction

AIS RX CARBON will be quick and simple to install. You will need a antenna cable and connectors for the VHF radio (included 2 m) on the RX CARBON + version, and power access of 12 V DC. When this is in place, your AIS RX CARBON can easily be connected to your PC or any other type of display system e.g. a plotter. Please be aware that the software that you use to display AIS data must be compatible with the standard messages that AIS provides on its output data port. The data output port sends serial data through a serial cable to the display system so that AIS targets can be displayed.

9.2 Installation

This part describes the most important information you need to install your AIS RX CARBON receiver. You should read the entire manual to get a full understanding of how to install and operate your AIS RX CARBON. Please visit our webpage (www.trueheading.se) for updates on manuals etc.

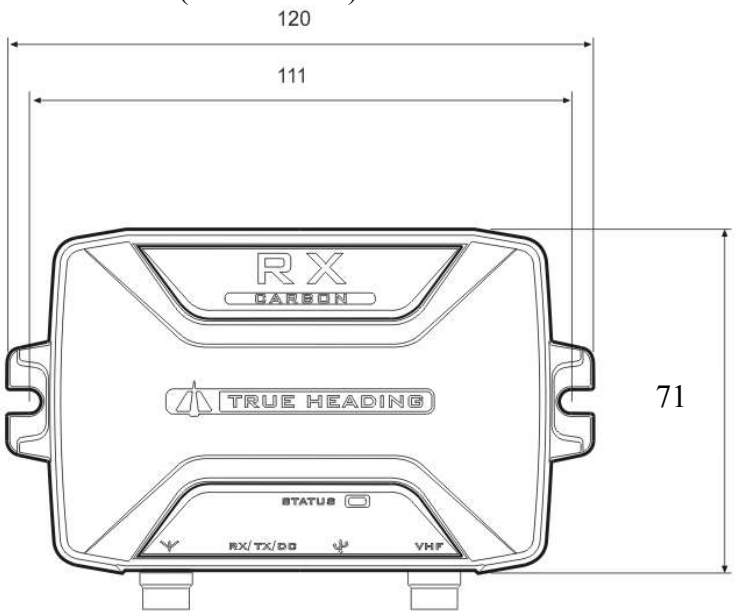
If you want your AIS RX CARBON to operate with e.g. monitor software, your plotter or a PC based software please act as follows:

9.2.1 Checking your material

Check that you have received all the equipment with your AIS RX CARBON and that the delivered equipment has not been damaged during delivery. If the equipment has been damaged, please contact your reseller or our support.

9.2.2 Installing your receiver

AIS RX CARBON is made to be installed in a protected environment (in door) and shall therefore be placed where it is well protected from humidity and water. AIS RX CARBON shall not either be placed close to generators or compressors from e.g. refrigerators since they can interfere with the reception. Normally a suitable placement of the AIS RX CARBON is together with other types of navigation equipment and the PC or plotter that will be used to display the AIS data, also a position close to a location where power is easy available is a good idea. AIS RX CARBON contains one led indicator for power, therefore it is a good idea to have the indicators viewable to ensure performance and functionality. AIS RX CARBON is easy to mount on the bulkhead or panels with two normal screws (not included).



Picture 4 Measurements for the installation of the AIS RX CARBON.

9.2.3 Antenna installation

Install the VHF antenna at a suitable position onboard (see further below)
The antenna cabling should be installed the shortest possible way and cable type selected depending on cable length to avoid losses. All connectors should be properly connected to avoid losses and thoroughly sealed with self-amalgamating rubber tape to avoid humidity in the connectors and thereby reduced functionality.

Quick quide for cable selection

Length	Cable types
< 10 m cables	RG58C/U
> 10 m cables	RG213/U

9.2.4 Compass safe distance

The table below shows suitable safety distances to other equipment that could cause interference with the AIS receiver.

Object	Safety distance
Radar antenna, X-band	1, 5 m (5 ft)
High efficiency engines	1 m (3 ft)
HF or VHF antennas	3 m (10 ft)
AC power cables with high currency	1 m (3 ft)
Satelitcommunication antennas	4 m (13 ft)

9.2.5 VHF antenna

AIS RX CARBON is not delivered with a VHF antenna as standard since requirements for the antenna and the cables can be different in various types of installations. The VHF antenna is necessary for the AIS receiver to work properly. VHF antennas can normally be provided by marine electronic shops. True Heading can also provide a suitable package including a high quality low cost VHF antenna adapted for AIS RX CARBON. Please ask for our VHF antenna or our package solutions. The antenna cable type should be at least RG58C/U or better.

The VHF antenna installation is often a compromise of the following requirements:

- Separation between different antennas
- Free line of sight 360 degrees
- Antenna height

Antenna separation

The AIS receiver uses frequencies in the upper part of the maritime band. Normally channel 87B, AIS 1 (161.975 MHz) and channel 88B, AIS 2 (162.025 MHz). AIS frequencies are situated in the duplex band close to coastal stations transmit channels. To avoid interference the AIS RX CARBON antenna shall be separated as much as possible from the ordinary VHF antenna. The best separation will be accomplished if the antennas are placed on different heights or placed on different sides off the mast or boat. True Headings VHF splitter can also be used as an effective solution to the antenna placing.

Line of sight
To have the best possible reception for the AIS RX CARBON the antenna shall be placed with free line of sight around the full horizon. Larger objects can stop the signals from certain directions.

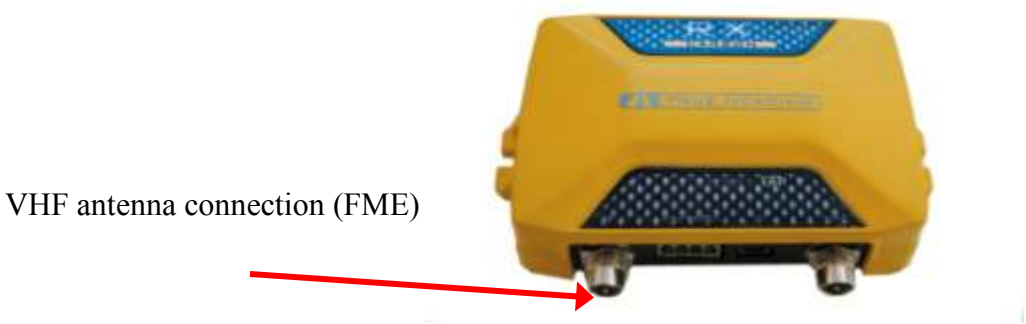
Antenna height
AIS use frequencies in the maritime VHF band. The area of coverage in this frequency band is almost the same as line of sight. This means that the higher you put your antenna the longer range you will obtain.

The VHF antenna shall be of a standard marine type for full functionality off the AIS RX CARBON.

Antenna type: Vertical radiator
Antenna gain: 0 – 3 dBd
Impedance: 50 ohm

The VHF antenna to the AIS RX CARBON shall be placed as high as possible and with proper separation to other transmitting antenna equipment onboard. A suitable solution is to use the VHF antenna splitter from True Heading that allows you to use existing VHF antenna installations if existing. The VHF splitter solution will save both time and installation cost, further an existing VHF antenna is normally placed already on the most favorable location onboard.

The VHF antenna connection shall be connected to the right connector (BNC) on the AIS RX CARBON as shown below:



Picture 6 VHF antenna connection

9.2.6 Power

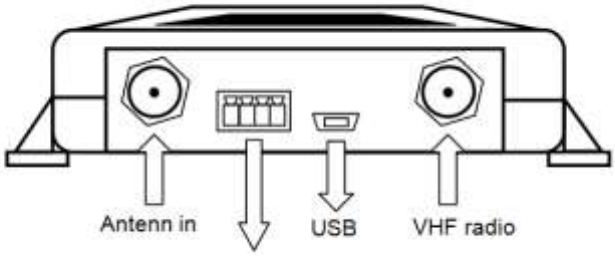
Connect the AIS RX CARBON to 12 V DC via a 0,5A fuse. The AIS RX CARBON requires a power cable already with a fuse that connects to the included socket connector that comes with the receiver according to picture 8.

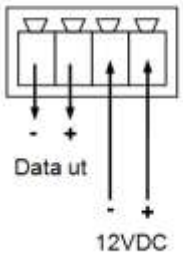
Red cable is positive	

Black cable is negative	

When AIS RX CARBON is connected to 12 VDC the PWR (POWER) led indicator shall be green. When receiving data the led will flash.

Picture 7 Led Power and data indicator





Connection for data through USB mini and/or NMEA 0183 data port). Power can be provided from both USB and 12V DC direkt.

Picture 8 Data, antenna and power connection

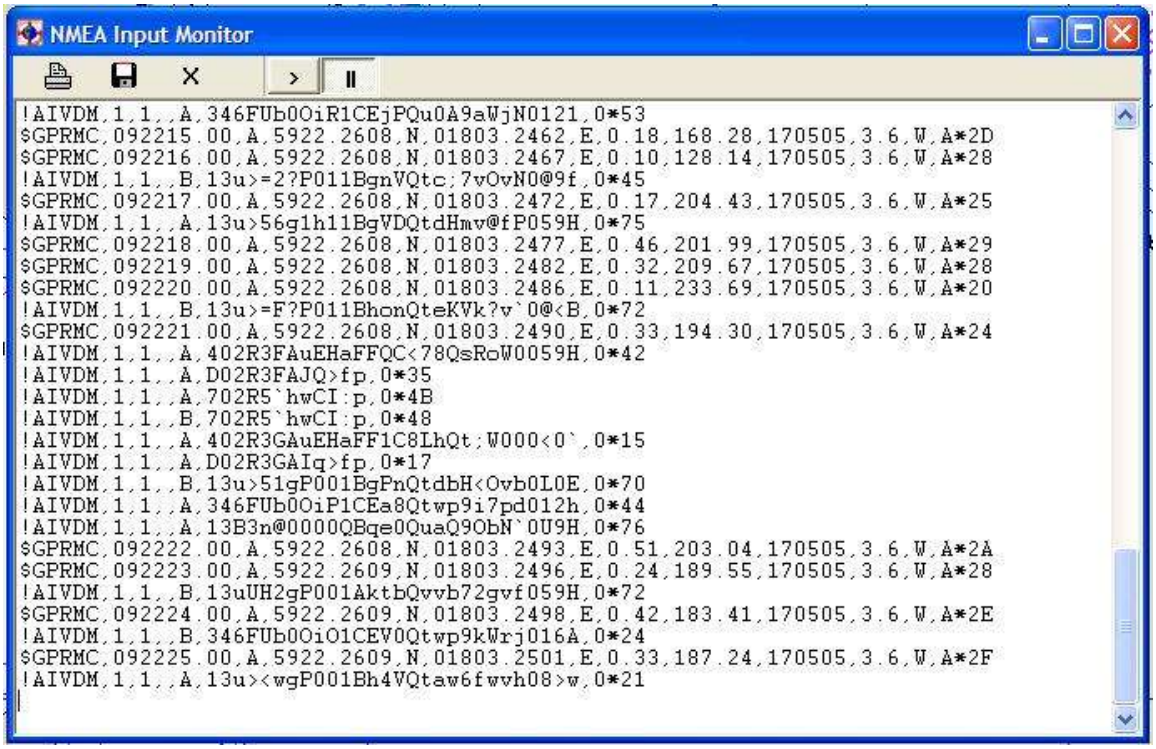
9.2.7 Connection to PC

Use the included USB cable for NMEA 0183 format. Connect the cable to the connector on the AIS RX CARBON and then to the PC. For plotters use the NMEA 0183 data port with a 2 pole cable connected.

Start your navigation system or plotter and set the baud rate to 38400 bit/s on the serial port where you connect your AIS RX CARBON.

Note: *If you do not have any AIS software you can use the Hyperlink program supplied with Windows. This can be found by pressing the Start button -> programs ->Accessories->Communications->HyperTerminal*
Set the com port for:
Baud rate: 38400
Data bit: 8
Parity: None
Stop bits: 1

When you your port is set to receive data as described above you shall be able to see NMEA data for AIS called VDM according to the example below that follows normal NMEA structure.

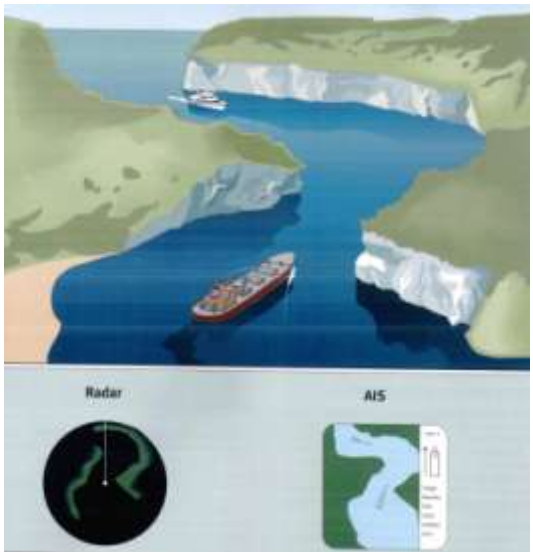


10 OPERATIONAL GUIDELINES FOR AIS RX CARBON

AIS RX CARBON has one (1) led indicator to help with status monitoring of the AIS receiver.

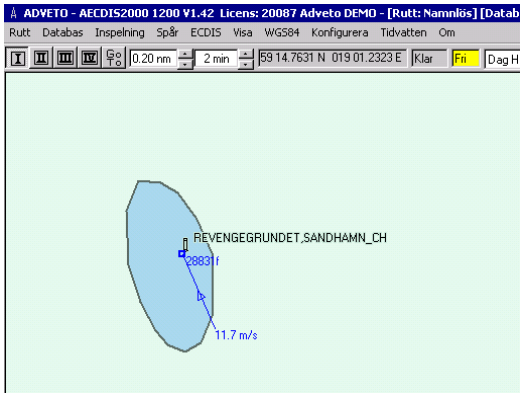
PWR is the abbreviation for POWER (Power connected) and shows with **green** fixed light that AIS RX CARBON is connected to power 12 VDC and flashes when AIS data is received.

AIS RX CARBON will give several possibilities to enhance the navigational safety as a complement to e.g. radars and electronic charting systems. With an AIS receiver, you will improve safety during navigation in e.g. low visibility or at night. At sea, AIS provides a support to the radar especially during rain, snow and sea clutter conditions. With AIS, it is also possible to se behind islands and bends something that will give an idea what's "behind the corner".



Picture 9 With AIS you can see behind island and bend.

Several Maritime authorities will also transmit safety related information using land based AIS networks. These are messages that will contain information about e.g. sudden threats in fairways, navigational warnings, meteorological data etc. Meteorological information will also be transmitted in real-time from certain strategic positions along coastlines. That data will contain information like Wind Speed, Wind Direction, Water Level, Temperature, Currents, and Tide etc.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Fri
REVENGEGRUNDET,SANDHAMN_CH
11.7 m/s

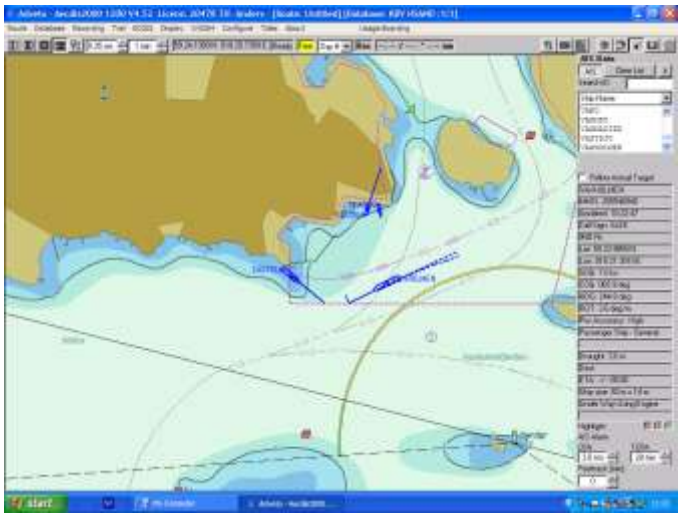
Picture 10 Meteorological data transmitted with AIS in real-time

AIS transponders will transmit the following data that can be received from your AIS RX CARBON:

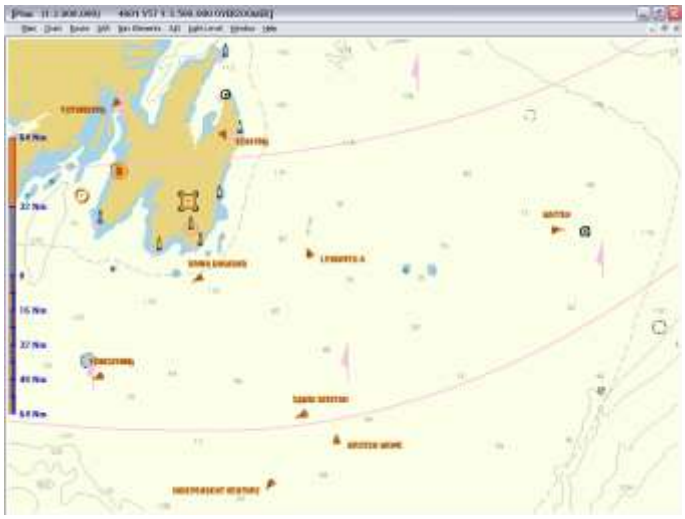
Static Information	**Dynamic Information**	**Voyage related Information**
□□Name	□□Position	□□Destination
□□Type of ship	□□Speed Over Ground	□□Depth
□□Call sign	□□Course Over Ground	□□ETA
□□MMSI number	□□Rate Of Turn	□□Navigational Status
□□IMO number	□□Heading	
□□Size		

Note: Sometimes ships have not properly programmed their AIS transponders and parts of above-mentioned information can then be missing.

AIS RX CARBON can without charge be provided with the electronic chart system SeaClear. SeaClear is presented separately with its own user manual. Below some examples of how AIS can be presented in various types of electronic chart systems or plotters. At present, several manufacturers can provide systems that can display AIS. A list of the once known to us can be found in the chapter FAQ.



Picture 11 Example how AIS is presented in the software AECDIS from ADVETO.



Picture 12 Example how AIS is presented in the software HORIZON from ICAN.

Picture 13 Example how AIS is presented in SeaClear.

Picture 14 Example how AIS is presented in AIS Yacht.

11 FAQ

Q: Is it possible to use an existing VHF antenna?

A: Yes, you can use an existing VHF antenna with the AIS RX CARBON + version otherwise a by adding the True Heading VHF antenna splitter to the installation. Then the same antenna used for VHF/DSC can be used also for the AIS RX CARBON.

Q: What type of VHF antenna do I need for my AIS RX CARBON?

A: The VHF antenna should at least fulfill the following requirements:

Antenna type: Vertical radiator
Antenna gain: 0 – 3 dBd
Impedance: 50 ohm

Q: Is it possible to connect my AIS RX CARBON to a plotter?

A: Today most plotters are prepared to connect AIS and to display AIS targets. For further information contact your supplier and ask about AIS interface to their product.

Q: What electronic chart programs can handle AIS today AIS?

A: Today several software are prepared for AIS, the once known to us are Adveto AECDIS series, Fugawi, Fugro, ICAN Aldebaran, Nobeltech, SeaClear, Transas Navisailor. All software that can handle the NMEA message VDM and display the data will be able to present AIS. Ask your provider for further information. In addition, stand-alone display software is available like e.g. the AIS YACHT from Y-tronic.

Q: Will AIS RX CARBON work with my network solution onboard?

A: All networks that can handle NMEA VDM data at the speed 38400 b/s will be able to handle AIS data. Most exisiting data networks will not. Ask your network provider for further information.

Q: I do not have a serial port on my computer, how can I then get the data from my AIS RX CARBON into the PC?

A: The AIS RX CARBON has both a serial port and a USB port for easy connection both to a plotter and a PC at the same time.

12 NOTES